A collection of sea spiders (Pycnogonida: Pantopoda) in the National Museum, Prague (Czech Republic)

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Abstract. The arachnological collection of the National Museum, Prague contains material preserved in ethanol and a microscopic slide of recent sea spiders (Pycnogonida: Pantopoda). The collection is small, containing only twelve specimens. A revision of all of them revealed the presence of nine species from five families: *Anoplodactylus lentus* Wilson, 1878, *Boreonymphon abyssorum* (Norman, 1873), *Callipallene* sp., *Endeis spinosa* (Montagu, 1808), *Nymphon grossipes* (Fabricius, 1780), *Nymphon hirtipes* Bell, 1853, *Nymphon stroemi* Krøyer, 1844, *Nymphon tenellum* (Sars, 1888) and *Pycnogonum litorale* (Ström, 1762). The material preserved in ethanol was collected in the North Atlantic Ocean and adjacent seas, the pycnogonid mounted on the slide was collected in Mediterranean. Four of the sea spiders came from the Sars collection (Bergen, Norway) and four specimens came from the V. Frič collection (Prague, Czech Republic). From these two sources, six specimens were mounted for exhibition and educational purposes. Although the collection contains no types, it introduces an interesting group of marine animals.

Keywords: Callipallenidae, Endeidae, Frič, Nymphonidae, Phoxichilidae, Pycnogonidae, Sars, zoological collection

I would like to dedicate this paper to two scientists who passed away in 2015: Roger Norman Bamber, a specialist on Pycnogonida, and Jan Buchar, an arachnologist and my supervisor.

Sea spiders (Pycnogonida) are strange looking, exclusively marine invertebrates feeding on sessile or slow-moving (or sometimes dead) animals. However, catching quick-moving prey was also reported (Lotz 1968). They are often considered the sister group of Euchelicerata, i.e. a class of the subphylum Chelicerata but alternative hypothesis also exist – see Dunlop et al. (2014) for a review.

Their body, termed the trunk, is extremely reduced and serves just as attachment for the legs. The first segment, the cephalosoma, contains four primordial segments that are telescoped into the first trunk segment – the first for an ocular tubercle with four eyes (may be absent) and a proboscis, and the next three giving rise to the appendage pairs of the chelifores, palps and ovigers. The fourth pair of appendages in the cephalosoma is the first pair of walking legs and belongs to the trunk (Winter 1980). Behind the cephalosoma, there are three trunk segments, each bearing a pair of nine-articled walking legs comprised from coxa 1, coxa 2, coxa 3, femur, tibia 1, tibia 2, tarsus, propodus and the main claw. There has been long-lasting controversy concerning which appendages are homologous among arthropods. According to Jager et al. (2006), Manuel et al. (2006) and Brenneis et al. (2008), the pycnogonid appendages are homologous to those of euchelicerates and mandibulates as follows: chelifores ~ chelicerae ~ antennae I (innervated from deutocerebrum), palps ~ pedipalps ~ antennae II (innervated from tritocerebrum), ovigers ~ legs I ~ mandibles, legs I ~ legs II ~ maxillae I, legs II ~ legs III ~ maxillae II. The last (fourth) trunk segment bears the abdomen which is reduced to a small protuberance.

The reduced body of sea spiders causes several organ systems, like the intestine and gonads, to protrude into the legs, such that the genital openings are often located on the ventral surface of coxa 2 (usually of legs III and IV). Eggs are stored in the femora of all legs of the female. The typical first larval form (feeding on cnidarians), the protonymphon, usually hatches from the eggs that are carried by the male in many families. The larval body possesses a proboscis, chelifores and two pairs of ambulatory legs that turn into palps and ovigers during ontogeny. Information about biology of sea spider can be found in Arnaud & Bamber (1987).

Catalogues of sea spiders were published by museums in Germany (Dunlop et al. 2007, Weis et al. 2011, Lehmann et al. 2014). The National Museum in Prague has already published catalogues of various non-type zoological material (e.g. Jiroušková et al. 2011, Mlíkovský et al. 2013, Dolejš & Vaňousová 2015) and this paper continues by providing information about the sea spider collection in Prague.

Material and methods

All eleven ethanol-preserved pycnogonid specimens are kept in 80 % ethanol. Eight of them had been identified, three (plus the specimen mounted on the slide) only to genus level. Therefore, all specimens were first revised based on the literature mentioned below each species. Of the formerly identified specimens, only two of them had been identified correctly. Thus, labels with appropriate species names were put on the jars. Second, specimens were cross-referenced with the accessory catalogues. However, data for only four specimens were found in the catalogues (N°s 1876/1902, 19/1960/3066 and 19/1960/3109); the remaining specimens thus have a "general" number for Pycnogonida: P6d-9/2003 (P6j-118/1988 for the specimen mounted on the slide). Conversely, one specimen was not found in the collection despite being mentioned in the accessory catalogue from the year 1902: *Colossendeis proboscidea* (Sabine, 1824) from Bjørnøya ("W von Bären Insel"). This specimen had come to the National Museum in Prague as an exchange from the Museum für Naturkunde Berlin on 21 October 1902 (accessory N° 1875/1902), but was either lost or destroyed. The remaining specimens in Berlin are deposited under N° ZMB 19 (Dunlop et al. 2007).

The third step was the determination of sex and measuring body lengths using an Olympus SZX12 stereomicroscope equipped with an ocular micrometer. Males were recognized by the presence of cement gland openings and hairy swellings located distally on the fifth article of the ovigers helping the

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(nymphonid) males in carrying the eggs. Females were recognized according to the swollen femora of the legs (and sometimes eggs visible inside them) without cement glands and missing ovigers (except members of the families Callipallenidae and Nymphonide where ovigers are also present in females but the swellings are lacking) (Bamber 2010). The body length in sea spiders means the distance between the anterior margin of the cephalosoma (i.e. without the proboscis) and posterior margin of the last (fourth) segment including the lateral processes but not the abdomen (Just 1972, Bamber 2010).

Current nomenclature and the Life Science Identifier numbers (lsid) were adopted from PycnoBase (Bamber et al. 2015). The species are arranged systematically according to Bamber (2010). Data for each specimen are arranged as follows: Material – number of specimens (with a note in the case they are mounted), their sex (body length), name of the collector, date of collection and locality. Identification – name on the original label and literature used for revision/redetermination/identification. Biology and ecology – any available data. Notes – if any.

Systematic list

Class: Pycnogonida Latreille, 1810
Order: Pantopoda Gerstäcker, 1863
Suborder: Eupantopoda Fry, 1978
Superfamily: Nymphonoidea Pocock, 1904
Family: Nymphonidae Wilson, 1878
Genus: *Boreonymphon* Sars, 1888

***Boreonymphon abyssorum* (Norman, 1873)**

urn:lsid:marinespecies.org:taxname:134676
Material. 1 ♀ (7.0 mm) collected by F. A. Dohrn on an unknown date in the Barents Sea, RUSSIA (Fig. 1).
Identification. Originally labelled as *Boreonymphon robustum* Bell, redetermined according to Just (1972) and Bamber (2010).
Biology and ecology. Depth 500-2000 m (Bamber 2010).
Notes. Came to the National Museum as an exchange from the Museum für Naturkunde Berlin on 21 October 1902 (accessory № 1876/1902). The remaining specimens in Berlin are deposited in two vials under № ZMB 64 and are labelled as *B. robustum* (Dunlop et al. 2007). It is probable that they were also erroneously identified and that they are in fact *B. abyssorum* like the specimen deposited in Prague.

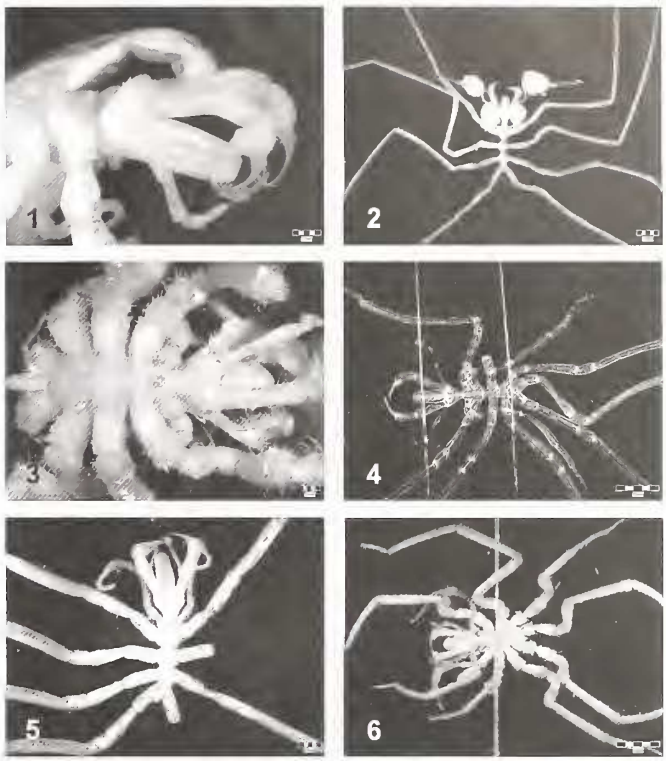
Genus: *Nymphon* Fabricius, 1794

***Nymphon grossipes* (Fabricius, 1780)**

urn:lsid:marinespecies.org:taxname:134688
Material. 1 mounted pair: ♂ (5.5 mm) and ♀ (4.8 mm) without any data; ex. coll. V. Frič (№ 19/1960/3066) (Fig. 2).
Identification. Originally labelled as *Nymphon* sp., identified according to Turpaeva (2009), Bamber (2010) and de Kluijver & Ingalsuo (2015).
Biology and ecology. Depth usually 6-400 m (Bamber 2010), on silty sand, rock and shells (Turpaeva 2009).

***Nymphon hirtipes* Bell, 1853**

urn:lsid:marinespecies.org:taxname:134690
Material. 1 ♂ (8.0 mm) collected by an unknown collector on an unknown date in the Davis Strait; ex. coll. V. Frič (№ 19/1960/3109) (Fig. 3).



Figs 1-6: Nymphonidae. **1.** *Boreonymphon abyssorum*, lateral view of the anterior part of the female body; **2.** *Nymphon grossipes*, an ovigerous male; **3.** *Nymphon hirtipes*, a male with malformed left chelifore; **4.** *Nymphon stroemi*, a mounted subadult specimen from Bergen; **5.** *N. stroemi*, a juvenile from the North Sea; **6.** *Nymphon tenellum*, a male from Bergen. Scale bars 1 mm (Figs 1, 3), 2 mm (Figs 2, 5), 5 mm (Figs 4, 6)

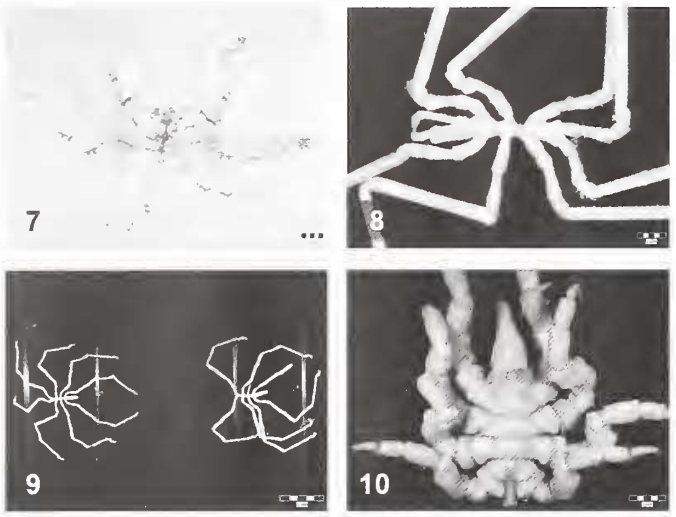
Identification. Originally labelled as *Chaetonymphon hirtipes*, revised according to Hedgpeth (1948), Child (1982) and Turpaeva (2009).
Biology and ecology. Depth 3-1506 m, on silty sediments (Turpaeva 2009).
Note. Left chelifore malformed and left oviger with extra projections.

***Nymphon stroemi* Kroyer, 1844**

urn:lsid:marinespecies.org:taxname:134711
Material. 1 mounted subadult specimen (8.0 mm) collected by an unknown collector on an unknown date in Bergen, NORWAY; ex. coll. Sars (Fig. 4).
Identification. Originally labelled as *Nymphon grossipes* Fabr., redetermined according to Turpaeva (2009), Bamber (2010) and de Kluijver & Ingalsuo (2015).
Material. 1 juvenile specimen (8.3 mm) collected by an unknown collector on an unknown date in the North Sea (Fig. 5).
Identification. Originally labelled as *Nymphon* sp., identified according to Turpaeva (2009), Bamber (2010) and de Kluijver & Ingalsuo (2015).
Biology and ecology. Depth 12-1300 m (Bamber 2010), on silty sediments (Turpaeva 2009).

***Nymphon tenellum* (Sars, 1888)**

urn:lsid:marinespecies.org:taxname:134712
Material. 1 mounted ♂ (5.2 mm) collected by an unknown collector on an unknown date in Bergen, NORWAY; ex. coll. Sars (Fig. 6).



Figs 7-10: Non-nymphonid sea spiders. **7.** *Callipallene* sp., a juvenile mounted on a microscopic slide, scale bar 0.5 mm; **8.** *Anoplodactylus lentus*, a female from Woods Hole, scale bar 1 mm; **9.** *Endeis spinosa*, two mounted females, scale bar 5 mm; **10.** *Pycnogonum litorale*, a female from Puffin Island, scale bar 2 mm

Identification. Originally labelled as *Nymphon hirtum* F., redetermined according to Child (1982), Bamber (2010) and de Kluijver & Ingalsuo (2015).
Biology and ecology. Depth mainly 200-600 m (Bamber 2010). Glandular secretions used by paternal care were described by Dogiel (1911, sub *Chaetonymphon spinosum*).

Family: Callipallenidae Hilton, 1942
Genus: *Callipalleue* Flynn, 1929
***Callipallene* sp.**
Material. 1 juvenile specimen (0.7 mm) mounted on a microscopic slide, collected by F. B. Liechtenstern, on 24 September 1879 in Rovinj, CROATIA (Fig. 7).
Identification. Originally labelled as *Pycnogonum*, redetermined according to Bamber (2010), Lehmann et al. (2014) and de Kluijver & Ingalsuo (2015).
Biology and ecology. The callipallenids show a direct development via a postlarva on the male (Bamber 2010).
Note. Five common *Callipallene* species occur in Mediterranean (Lehmann et al. 2014).

Superfamily: Phoxichilidioidea Sars, 1891
Family: Phoxichilididae Sars, 1891
Genus: *Anoplodactylus* Wilson, 1878
***Anoplodactylus lentus* Wilson, 1878**
urn:lsid:marinespecies.org:taxname:158478
Material. 1 ♀ (3.5 mm) collected by an unknown collector in July 1891 in Woods Hole, USA (Fig. 8).
Identification. Originally labelled as *Phoxichilidium maxillare*, redetermined according to Hedgpeth (1948) [generic placement also according to Turpaeva (2009) and Bamber (2010)].
Biology and ecology. Ontogeny was described by Morgan (1891, sub *Phoxichilidium maxillare*) and the coloured granules in the hemolymph by Dawson (1934).

Family: Endeidae Norman, 1908
Genus: *Endeis* Philippi, 1843
***Endeis spinosa* (Montgau, 1808)**
urn:lsid:marinespecies.org:taxname:134674
Material. 2 mounted (from dorsal and ventral view) ♀♀ (2.2 mm) collected by an unknown collector on an unknown date in Bergen, NORWAY; ex. coll. Sars (Fig. 9).
Identification. Originally labelled as *Pallene spinipes* F., redetermined according to Bamber (2010) and de Kluijver & Ingalsuo (2015).
Biology and ecology. Mainly from the littoral zone to depths of 40 m, feeding on hydroids, but also common on algae (Bamber 2010). Ontogeny was described by Dogiel (1913, sub *Phoxichilus spinosus*).

Superfamily: Pycnogoidea Pocock, 1904
Family: Pycnogonidae Wilson, 1878
Genus: *Pycnogonum* Brünnich, 1764
***Pycnogonum litorale* (Ström, 1762)**
urn:lsid:marinespecies.org:taxname:239867
Material. 1 ♀ (6.3 mm) collected by J. Thompson on an unknown date at the Puffin Island Biological Station, UNITED KINGDOM (Fig. 10).
Identification. Originally labelled as *Pycnogonum litorale*, revised according to Turpaeva (2009), Bamber (2010) and de Kluijver & Ingalsuo (2015).
Biology and ecology. From the littoral to 1262 m, feeding on sea anemones (Bamber 2010), on rocky, stony sediments (Turpaeva 2009). *Pycnogonum litorale* became one of the model species for studying various aspects of sea spiders (e.g. Vilpoux & Waloszek 2003, Ungerer & Scholtz 2009, Machner & Scholtz 2010) given its fairly well known biology (e.g. Tomaschko et al. 1997, Wilhelm et al. 1997 and references therein).

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